



TECHNICAL NOTE

TO: Mr. Benoît Dubreuil, Co-chair, Joint Assessment Committee
Mr. John Paul Murdoch, Co-chair, Joint Assessment Committee
Mr. Denis Couture, Executive Canada, Galaxy Lithium
Mrs. Gail Amyot, Specialist HSE, Galaxy Lithium

COPY: Mr. Guillaume Clément-Mathieu, Project Manager, IAAC

FROM: Mrs. Dominique Thiffault, Project Director, WSP Canada Inc.

SUBJECT: **Alternative Solution for Road Construction**
James Bay Lithium Mine Project

PROJECT NO.: 201-12362-00

DATE: March 8, 2022

The purpose of this technical note is to present the proposed alternative for the construction of haul roads for the James Bay Lithium Mine Project following the information request received on March 3, 2022 from the Joint Assessment Committee.

Considering the concerns raised by federal and provincial experts regarding the proposed road design, the decision was made to install a geomembrane to better protect surface water and groundwater from possible contamination that could be generated by the waste rock used as a rolling layer, in accordance with the applicable criteria.

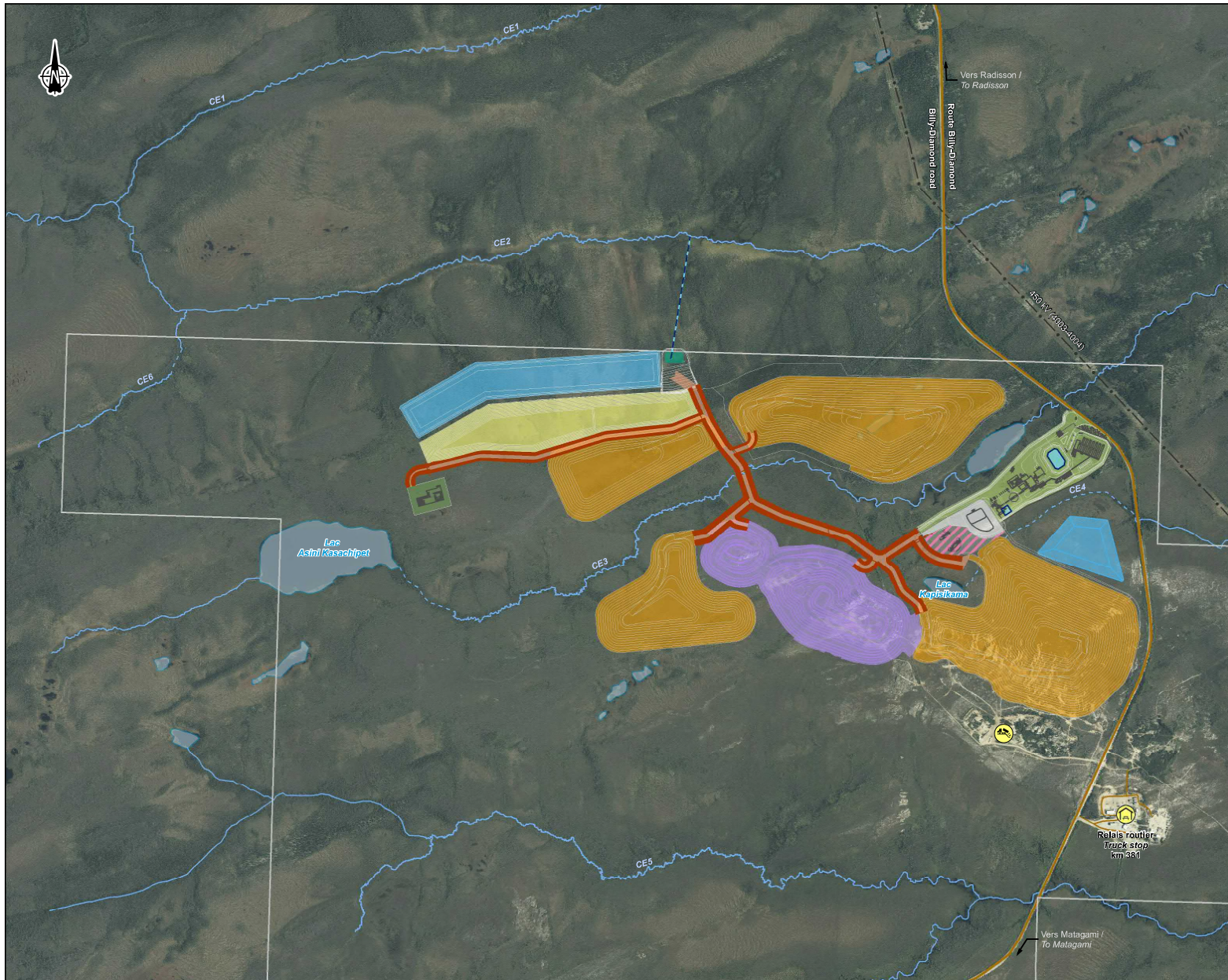
Haul roads will have a total length of 6.5 km, of which 1.2 km will be built directly on the waste rock stockpiles and thus, will not require a liner. Map 1 shows the location of the roads.

The roads will be 25 m wide and will be constructed according to the cross-section shown on Figure 1, except for the segments located on the stockpiles.

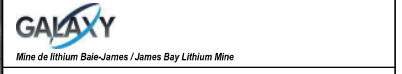
The foundation of the 5.3 km of roads, to be built on natural soil, will be established in overburden from the stripping of the pit surface and the administrative and industrial sector as well as the construction of the water retention basins, namely the north basin (main basin) and the east basin (Map 1). The overburden is composed of a mixture of sand, gravel and clay. This material will be compacted to obtain a solid foundation to allow the passage of haul trucks. A total of approximately 480,000 m³ of overburden will be needed to build the 5.3 km of roads.

The foundation will be covered with a 1.5-mm thick LLDPE geomembrane. This membrane will also cover the side ditches of the road and will be anchored on the lateral slope.

The road foundation and upper layers will be built with 2% slopes, to facilitate the drainage of precipitation towards the ditches.



- Limite de propriété / Property limit
- Composantes du projet / Project Component**
- Route / Road
- Effluent minier / Mine effluent
- Usine de traitement de l'eau / Water treatment plant
- Secteur administratif et industriel / Administrative and industrial sector
- Fosse / Pit
- Halde à minéral / ROM pad
- Halde à stériles / Waste rock stockpile
- Halde à matières organiques et dépôts meubles / Overburden and peat storage facility
- Entrepôt à explosifs / Explosives magazine
- Aire d'entreposage / Dry storage area
- Usine à béton (temporaire) / Concrete batch plant (temporary)
- Bassin de rétention d'eau / Water retention basin
- Infrastructures / Infrastructure**
- Route principale / Main road
- Route d'accès / Access road
- Ligne de transport d'énergie / Transmission line
- Relais routier / Truck stop
- Lieu d'enfouissement technique isolé / Isolated technical landfill
- Hydrographie / Hydrography**
- CE3 Numéro de cours d'eau / Stream number
- Cours d'eau permanent / Permanent stream
- Cours d'eau à écoulement diffus ou intermittent / Intermittent or diffused flow stream
- Plan d'eau / Waterbody



Carte / Map 1
Aménagement du site minier /
Mine Site General Arrangement

Sources :
 ©Image : Microsoft Bing (ESRI, 2017)
 Gestion : MRFN Québec, 210315
 Données du projet / Project data : Galaxy 2020

0 200 400 m
 UTM, fuseau 18, NAD83 **Mars / March 2022**

Dessiné : A. Masson
 Approuvé : C. Mathieu
 201-1295-00-01_wsp1304mod_mine_GA_202008.mxd

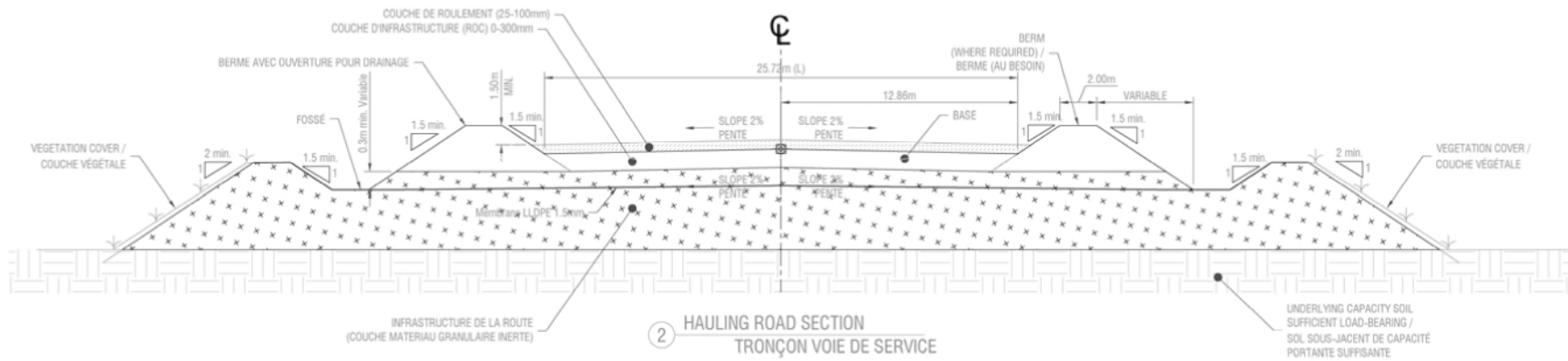


Figure 1 Hauling Road Cross-section

The membrane will first be covered with fine granular material, at least 300-mm thick, then with an infrastructure layer in 0-300 mm and the rolling surface in 25-100 mm. The infrastructure and surface layers will be constructed of waste rock. These layers will be considered and managed like waste rock stockpiles. About 200,000 m³ of waste rock will be needed to build these layers.

To have access to this material, GLCI will have to open a quarry in the footprint of the mine pit, since this work will be done before obtaining the mining lease. The opening of this quarry will require obtaining a *bail exclusive* (BEX) from the MERN and an authorization from the MELCC under Section 22 of the EQA.

Given the capacity of the haul trucks using these roads, it is important to have a certain thickness of rocky material and not only loose material for road construction. A thickness of 1 m of waste rock material is recommended by engineers.

The membrane will act as a sealing measure for groundwater. The daily seepage rate below the threshold of 3.3 L/m², recommended by the D019, will be respected.

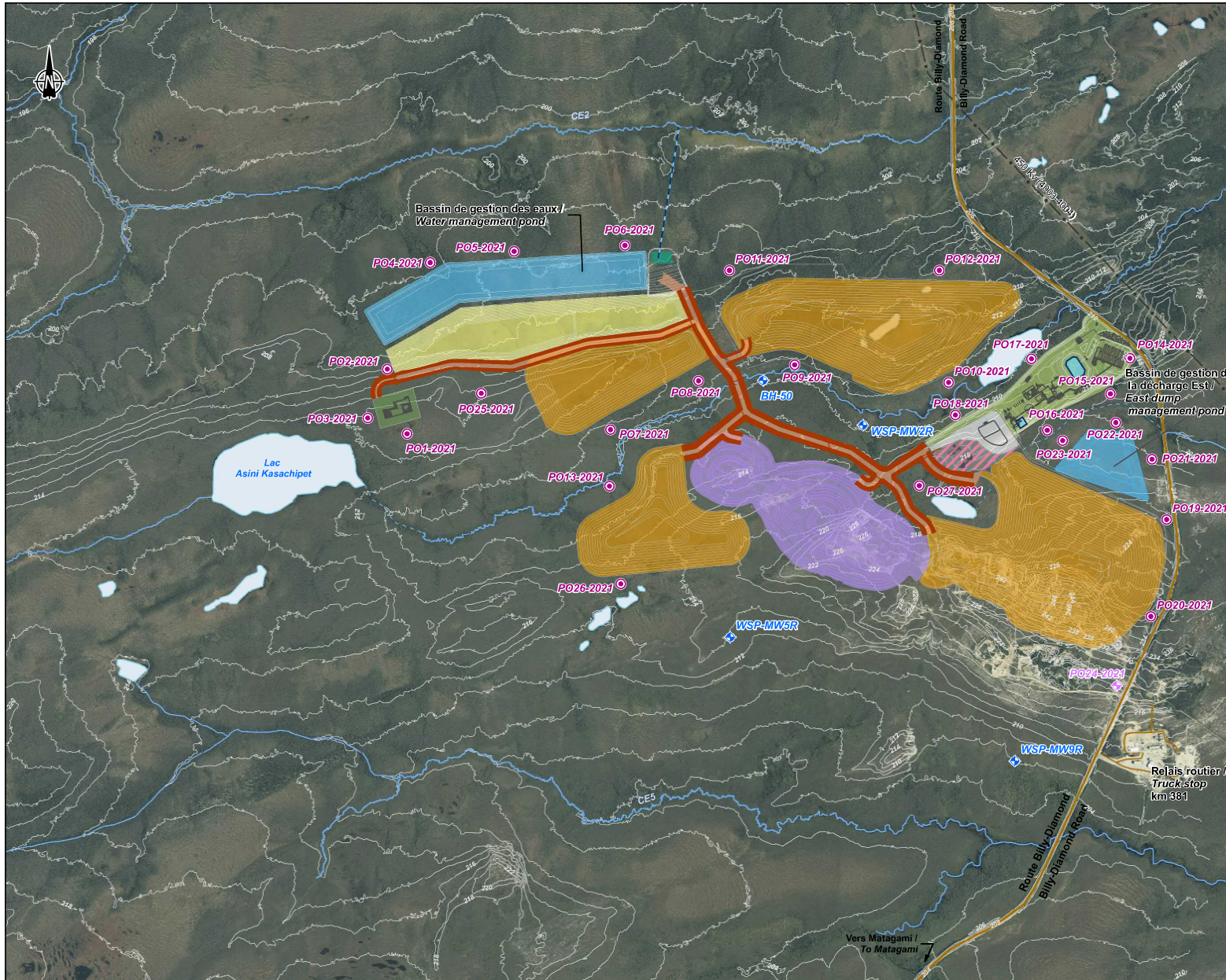
Surface water will be collected and directed by gravity and pumping (depending on the sector) to the north water management pond (the main pond), then to the WTP and controlled to meet the criteria of the D019 and the REMMMD standards, and tend towards compliance with the EDOs before their discharge into the CE2.

Additional monitoring wells will be installed along the roads to monitor groundwater quality. Groundwater sampling of at-risk infrastructure (Map 2) will be conducted as requested by Section 2.3 of D019 and compared to the resurgence criteria. If an exceedance occurs, the search for the cause could lead to repairs to the membrane or local pumping to the north water management pond for possible treatment.

The water balance and surface water modelling remain the same and do not need to be updated. Indeed, in the previous design, rainfall on the roads was already directed to the ditches to reach the main water management pond and WTP. The seepage into the groundwater was considered not significant. The installation of the membrane is an additional protection; the volume of seepage will remain insignificant.

The closure plan will need to be modified to remove the upper layers of the roads (infrastructure and surface layers) and end them to the waste rock stockpiles.

The construction stages are modified as well as the water management during construction. The main activities are described below. The maps 4-8 to 4-10 presented in the EIA (WSP, 2021) have also been modified accordingly. They are presented in appendix.

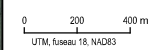


- Suivi des niveaux des eaux / Water level monitoring**
- Existing well / Puits existant
 - New well / Puits proposé
- Suivi de la qualité de l'eau / Water quality monitoring**
- New well / Puits proposé
- Infrastructures / Infrastructure**
- Main road / Route principale
 - Access road / Route d'accès
 - Transmission line / Ligne de transport d'énergie
 - Truck stop / Relais routier
- Hydrographie / Hydrography**
- Stream number / Numéro de cours d'eau (CE3)
 - Stream / Cours d'eau
 - Intermittent or diffused flow stream / Cours d'eau à écoulement diffus ou intermittent
 - Waterbody / Plan d'eau
- Composantes du projet / Project Component**
- Mine effluent / Effluent minier
 - Road / Route
 - Water treatment plant / Usine de traitement de l'eau
 - Administrative and industrial sector / Secteur administratif et industriel
 - Pit / Fosse
 - ROM pad / Halde à minéral
 - Waste rock stockpile / Halde à stériles
 - Overburden and peat storage facility / Halde à matières organiques et dépôts meubles
 - Explosives magazine / Entrepôt à explosifs
 - Dry storage area / Cour d'entreposage



Carte / Map 2
Suivi des eaux souterraines / Groundwater Monitoring

Sources :
Cartographie : Galaxy, août / august 2017
General Arrangement, 2020
Données du projet / Project data : Galaxy 2021



Mars / March 2022

Dessiné : A. Masson
Approuvé : C. Mathieu
201-1295-00-02_suivi_eaux_sout_wsp_202008.mxd



CONSTRUCTION STAGES

- **First month (Map 4-8 revised):**
 - Build development roads with overburden from the mine pit area.
 - Start the construction of the road foundation with overburden.
 - Open the area that will be dedicated to the industrial site and begin levelling.
 - At the crossing of the CE-3, install the culvert and sediment barriers.

- **Months 2 to 6 (Map 4-9 revised):**
 - Complete the levelling of the industrial site; the excess overburden will be kept to finalize the foundations of the roads.
 - Complete the construction of the foundation of the roads to be built on the natural soil. The overburden will come from the footprint of the mine pit, the industrial site, the footprint of the north water management pond and, if necessary, from the footprint of the east pond.
 - Install the construction water treatment plant.
 - Build the collection pond for the water to be controlled and treated before it is discharged to the CE2.
 - Prepare the waste rock extraction site:
 - Install the side berms to direct the water to the collection basin.
 - Build the ponds to collect drainage water.
 - Install the pumps and pipes towards the north water management pond and WTP.
 - Install the geomembrane on the foundation of the roads. This operation cannot be done in winter. Depending on the month in which the work begins, there may be a shutdown to ensure that the weather conditions are conducive to construction and geomembrane installation.

- **Months 7 to 12 (Map 4-10 revised):**
 - Install the temporary concrete batch plant.
 - Build the foundations on the industrial site.
 - On the roads, install the layer of fine materials on the geomembrane.
 - Blast the waste rock in the mine pit footprint.
 - Put the infrastructure layer on the roads with the 0-300 mm material that will have been sorted directly in the blasted area, without crushing.
 - Put the surface layer by crushing the waste rock on the road. The crusher will be moved as construction of the road progresses. Drainage water will be collected by ditches and directed to the WTP.

– **Months 12 to 18:**

- Road construction will be completed.
- There will be no changes in water management on the site.
- Construction of buildings.

Map 4-7 of the Environmental Impact Assessment – Version 2 (WSP, 2021) showing the water management during the operation phase has also been revised and is presented in appendix.

Based on the information presented, the impact assessment for the construction, operation and rehabilitation phases described in the Environmental Impact Assessment – Version 2 (WSP, 2021) remains unchanged.

Prepared by :

<Original signed by>

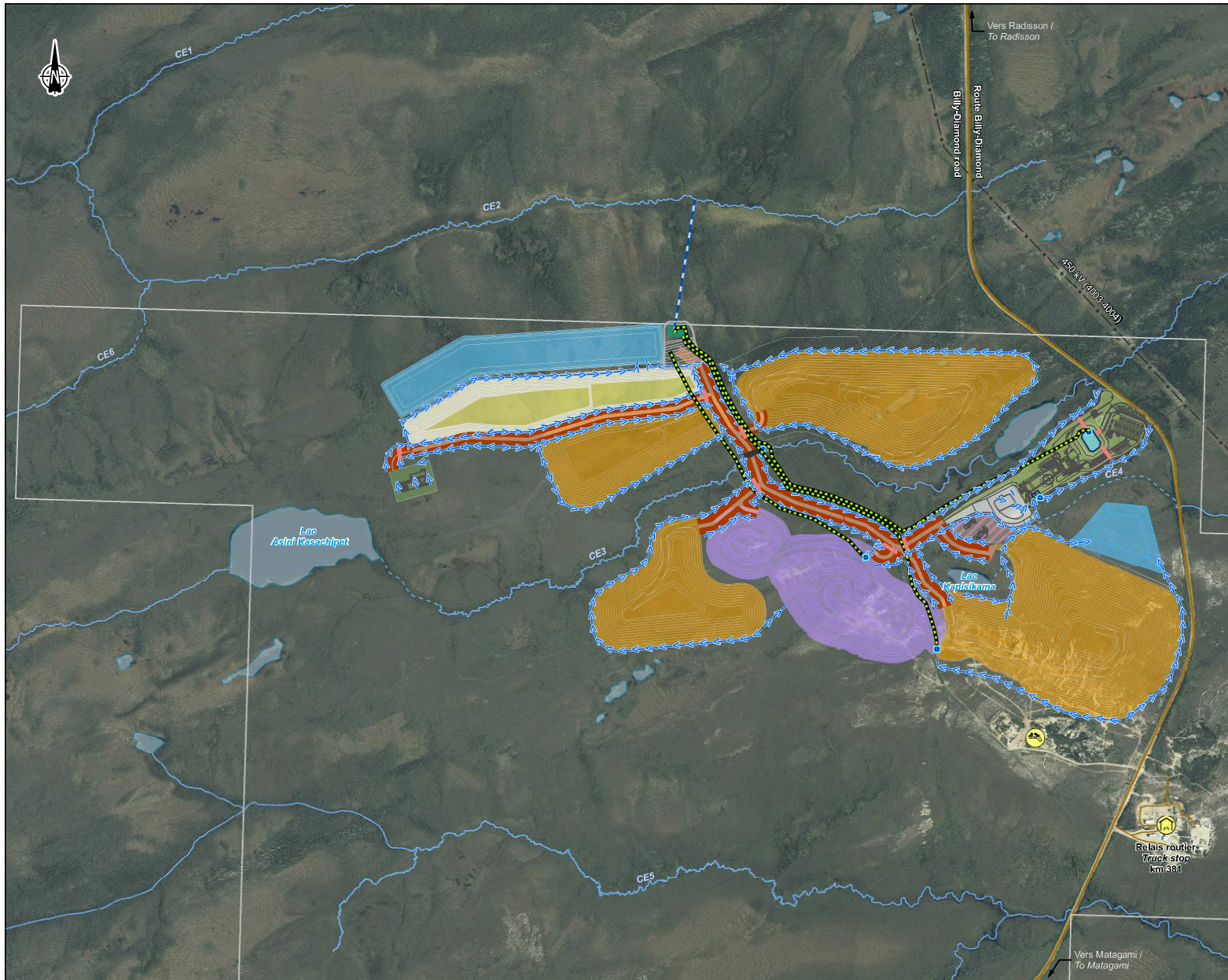
Dominique Thiffault, Project Director

DT/cg

Encl.: Appendix – Maps 4-7 to 4-10



APPENDIX
MAPS 4-7 TO 4-10



- Composantes du projet / Project Component**
- Limite de propriété / Property limit
 - Route / Road
 - Effluent minier / Mine effluent
 - Usine de traitement de l'eau / Water treatment plant
 - Secteur administratif et industriel / Administrative and industrial sector
 - Fosse / Pit
 - Halde à minéral / ROM pad
 - Halde à stériles / Waste rock stockpile
 - Halde à matières organiques et dépôts meubles / Overburden and peat storage facility
 - Entrepôt à explosifs / Explosives magazine
 - Aire d'entreposage / Dry storage area
 - Usine à béton (temporaire) / Concrete batch plant (temporary)
 - Bassin de rétention d'eau / Water retention basin
 - Ponceau de drainage / Drainage culvert
 - Ponceau / Culvert
 - Tuyau de collecte des eaux de ruissellement / Stormwater collection pipe
 - Station de pompe temporaire / Temporary pump station
 - ➔ Sens d'écoulement des eaux / Direction of water flow
- Infrastructures / Infrastructure**
- Route principale / Main road
 - Route d'accès / Access road
 - Ligne de transport d'énergie / Transmission line
 - Relevis routier / Truck stop
 - Lieu d'enfouissement technique isolé / Isolated technical landfill
- Hydrographie / Hydrography**
- CE3 Numéro de cours d'eau / Stream number
 - Cours d'eau permanent / Permanent stream
 - - - Cours d'eau à écoulement diffus ou intermittent / Intermittent or diffused flow stream
 - Plan d'eau / Waterbody

GALAXY
Mine de lithium Baie-James / James Bay Lithium Mine

Carte / Map 4-7 REV
Gestion des eaux en phase d'exploitation /
Water management during the operation phase

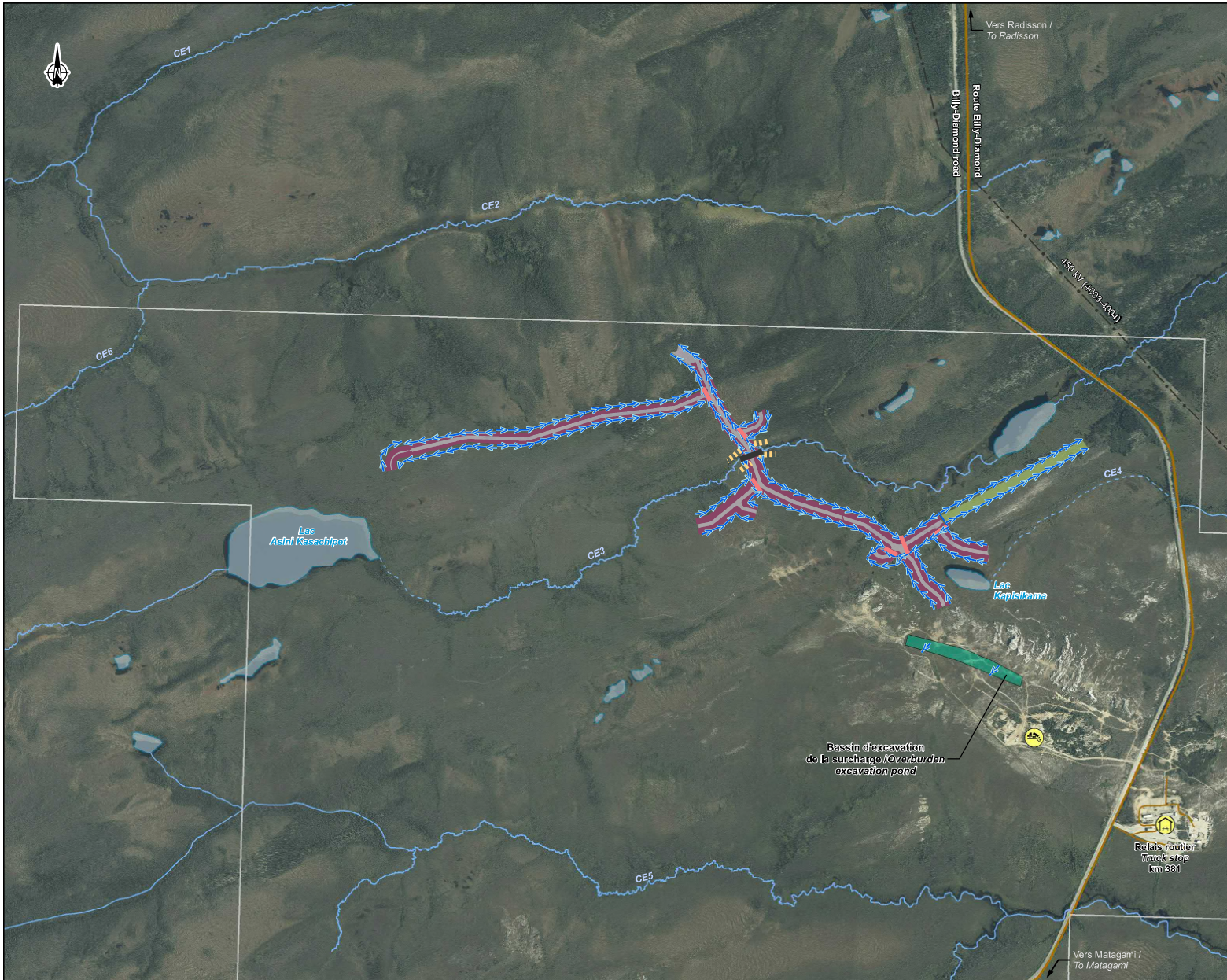
Sources :
 ©Image : Microsoft Bing (ESRI, 2017)
 Gestion : MINEF Québec, 210315
 Données du projet / Project data : Galaxy 2020

0 150 300 m
 UTM, fuseau 18, NAD83

Mars / March 2022

Dessin : A. Masson
 Approuvé : D. Thériault
 201-12365-00-04_7_msp1301_gest_eau_REV_220308.mxd

wsp



- Limite de propriété / Property limit
- Composantes du projet / Project Component**
- Assise de route / Road foundation
- Secteur administratif et industriel / Administrative and industrial sector
- Ponceau de drainage / Drainage culvert
- Ponceau / Culvert
- Barrière à sédiments / Sediment barrier
- Sens d'écoulement des eaux / Direction of water flow
- Infrastructures / Infrastructure**
- Route principale / Main road
- Route d'accès / Access road
- Ligne de transport d'énergie / Transmission line
- Relais routier / Truck stop
- Lieu d'enfouissement technique isolés / Isolated technical landfill
- Hydrographie / Hydrography**
- CE3 Numéro de cours d'eau / Stream number
- Cours d'eau permanent / Permanent stream
- Cours d'eau à écoulement diffus ou intermittent / Intermittent or diffused flow stream
- Plan d'eau / Waterbody

GALAXY
Mine de lithium Bale-James / James Bay Lithium Mine

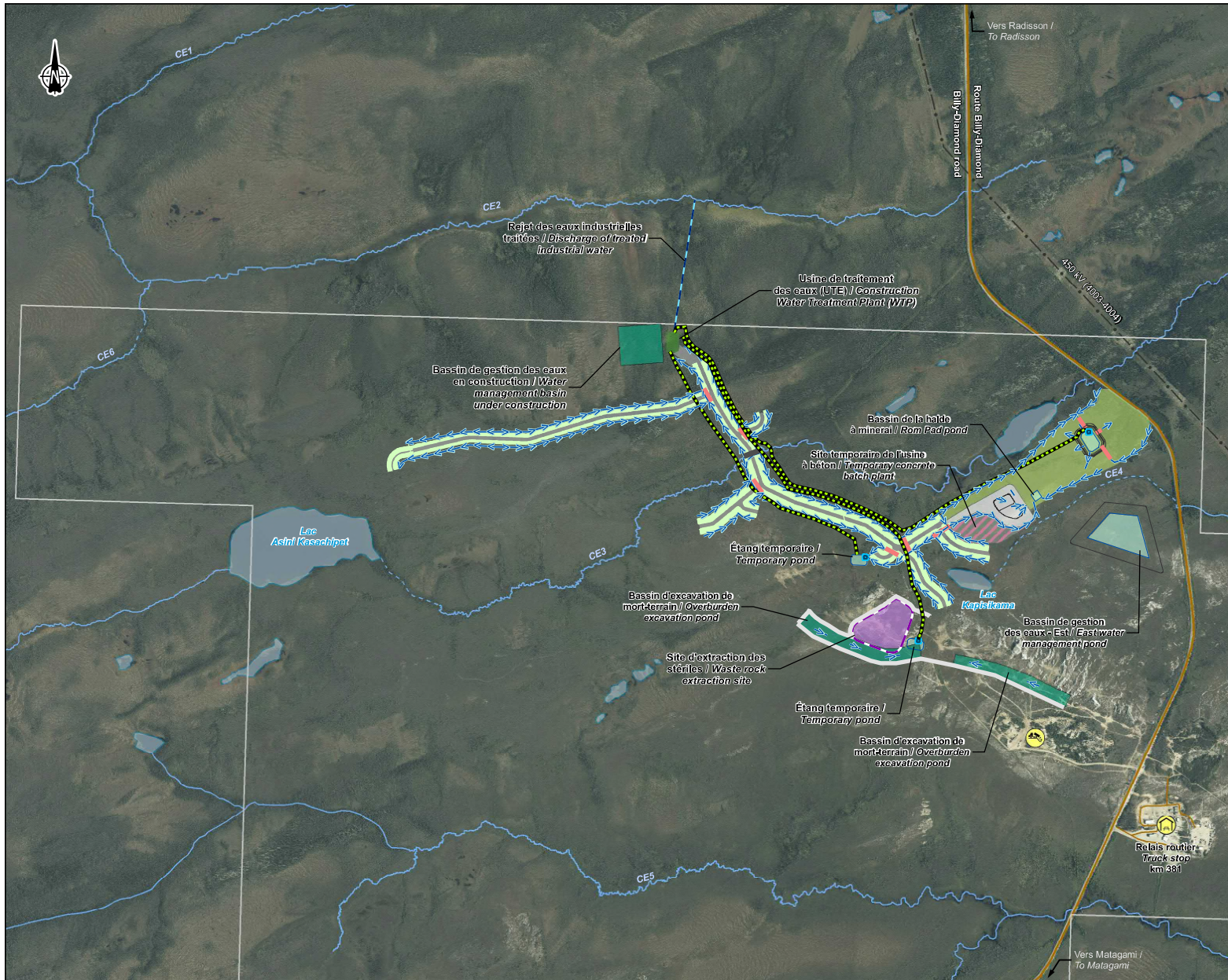
Carte / Map 4-8 REV
Gestion des eaux en phase de construction – Mois 1 /
Water management during the construction phase – Month 1

Sources :
Cartographie : Microsoft Bing (ESRI, 2017)
Géom : MRNF Québec, 210315
Données du projet / Project data : Galaxy 2021

Mars / March 2022

0 185 370 m
UTM, fuseau 18, NAD83

Design : A. Masson
Approbation : D. Thiffault
201-42362-901_04-8_REV_wsp380_gmt_eau_mois1_220308.mxd



- Composantes du projet / Project Component**
- Limite de propriété / Property limit
 - Route (membrane installée) / Road (membrane installed)
 - Secteur administratif et industriel / Administrative and industrial sector
 - Halle à minéral / ROM pad
 - Aire d'entreposage / Dry storage area
 - Bassin / Basin
 - Ponceau / Culvert
 - Effluent minier / Mine effluent
 - Tuyau de collecte des eaux de ruissellement / Stormwater collection pipe
 - Station de pompage temporaire / Temporary pump station
 - ➔ Sens d'écoulement des eaux / Direction of water flow
- Infrastructures / Infrastructure**
- Route principale / Main road
 - Route d'accès / Access road
 - Ligne de transport d'énergie / Transmission line
 - Relais routier / Truck stop
 - Lieu d'enfouissement technique isolé / Isolated technical landfill
- Hydrographie / Hydrography**
- CE3 Numéro de cours d'eau / Stream number
 - Cours d'eau permanent / Permanent stream
 - Cours d'eau à écoulement diffus ou intermittent / Intermittent or diffused flow stream
 - Plan d'eau / Waterbody

GALAXY
Mine de lithium Bale-James / James Bay Lithium Mine

Carte / Map 4-9 REV
Gestion des eaux en phase de construction – Mois 6 /
Water management during the construction phase – Month 6

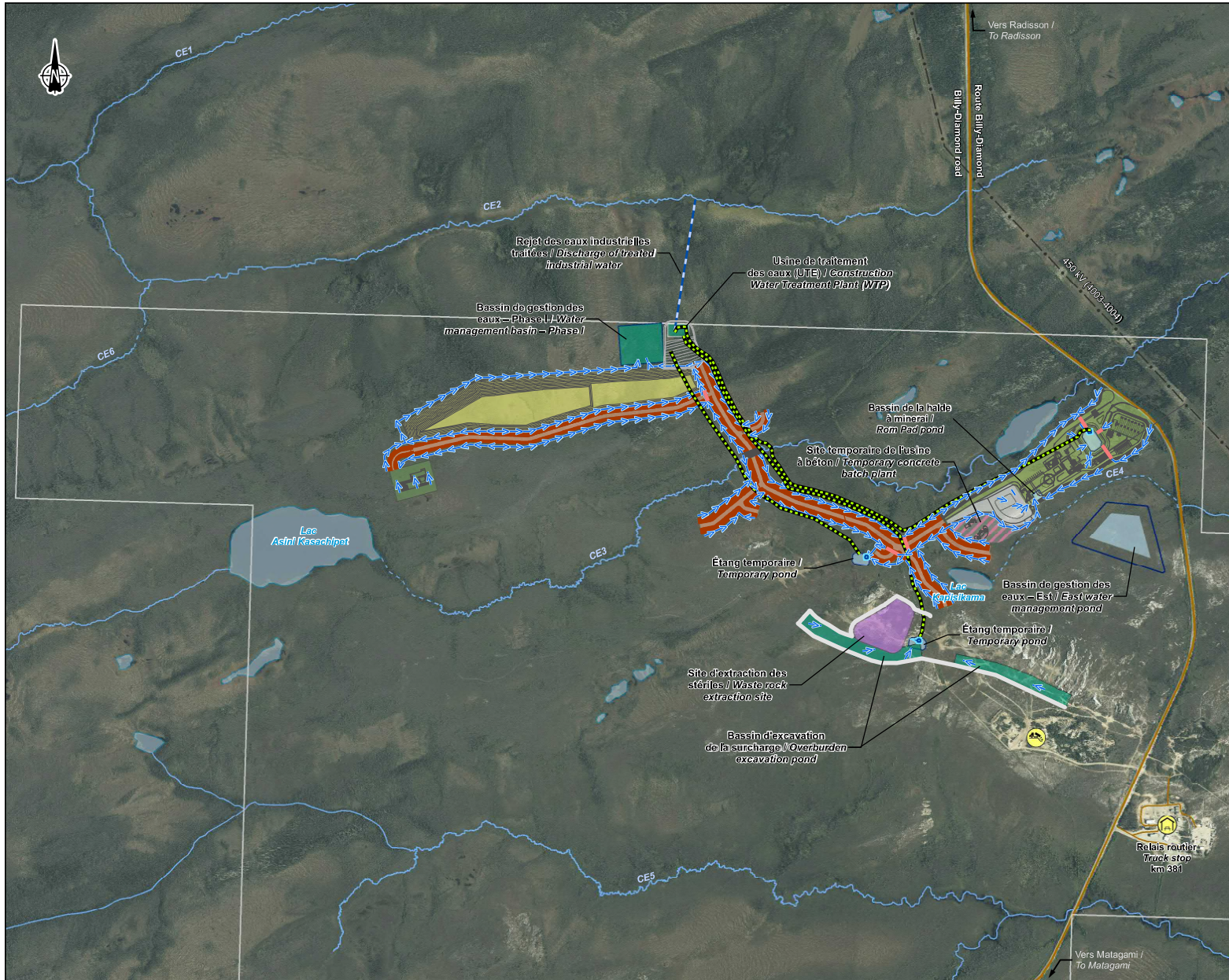
Sources :
Ordonnance : Galaxy, août 2017
Géom : MRNF Québec, 210315
Données du projet / Project data : Galaxy 2021

0 185 370 m
UTM, fuseau 18, NAD83

Mars / March 2022

Dessin : A. Masson
Approbation : D. Thériault
201-4292-01_04-9_REV_001_map_eau_mois_220308.mxd

wsp



- Limite de propriété / Property limit
- Composantes du projet / Project Component**
- Route complétée / Completed road
- Effluent minier / Mine effluent
- Usine de traitement de l'eau / Water treatment plant
- Secteur administratif et industriel / Administrative and industrial sector
- Fosse / Pit
- Entrepôt à explosifs / Explosives magazine
- Aire d'entreposage / Dry storage area
- Bassin / Basin
- Ponceau / Culvert
- Tuyau de collecte des eaux de ruissellement / Stormwater collection pipe
- Station de pompe temporaire / Temporary pump station
- Sens d'écoulement des eaux / Direction of water flow
- Infrastructures / Infrastructure**
- Route principale / Main road
- Route d'accès / Access road
- Ligne de transport d'énergie / Transmission line
- Relais routier / Truck stop
- Lieu d'enfouissement technique isolé / Isolated technical landfill
- Hydrographie / Hydrography**
- CE3 Numéro de cours d'eau / Stream number
- Cours d'eau permanent / Permanent stream
- Cours d'eau à écoulement diffus ou intermittent / Intermittent or diffused flow stream
- Plan d'eau / Waterbody

GALAXY
Mine de lithium Bale-James / James Bay Lithium Mine

Carte / Map 4-10
Gestion des eaux en phase de construction – Mois 12 /
Water management during
the construction phase – Month 12

Sources :
 Outils : Galaxys, août 2017
 Gestion : MRNF Québec, 21/03/15
 Données du projet / Project data : Galaxys 2021

0 185 370 m
UTM, fuseau 18, NAD83

Mars / March 2022

Dessin : A. Masson
 Approbation : D. Thiffault
 2014-0202-001_04-10_REV_001_TSR2_gest_eau_mois12_220109.mxd